

# *Entoloma fulvoviolaceum* Noordel. & Vauras - not previously reported from Norway

Øyvind Weholt, Siw Elin Eidissen, Jostein Lorås

Høgskolen i Nesna, NO-8700 Nesna, Norway

Corresponding author:  
oyvind.weholt@fredfiber.net

Norsk tittel: *Entoloma fulvoviolaceum* Noordel. & Vauras – ikke tidligere rapportert fra Norge

Weholt Ø, Eidissen SE, Lorås J, 2015. *Entoloma fulvoviolaceum* Noordel. & Vauras – not previously reported from Norway. *Agarica* 2015, vol. 36: 117-123.

## KEYWORDS

*Entoloma fulvoviolaceum*, Agaricales, Holmvassdalen Nature Reserve, Norway, calcareous soils

## NØKKELOORD

*Entoloma fulvoviolaceum*, Agaricales, Holmvassdalen naturreservat, Norge, kalkgrunn

## SAMMENDRAG

I Norge er *Entoloma fulvoviolaceum* funnet på minst fem ulike lokaliteter i Holmvassdalen naturreservat i Nordland i perioden 2009-2014. Denne rødsporen ble først beskrevet fra Finland i 2003. Sikre funn av arten fra andre land er ikke påvist. Artikkelen beskriver de norske funnene og gjør rede for artens økologi.

## ABSTRACT

In the period 2009-2014 *Entoloma fulvoviolaceum* was found in at least five different locations in Holmvassdalen Nature Reserve in North Norway. The species was first described from Finland in 2003, and so far Holmvassdalen is the only place where it with certainty has been reported outside the

type locality. Details of macro- and microscopical features and ecology are presented in the article.

## INTRODUCTION

In the period 2007-2014 hundreds of specimens of the genus *Entoloma* were collected in Holmvassdalen Nature Reserve, in the county of Nordland, mainly by Siw Elin Eidissen and Jostein Lorås. The first author, who provided microscopy of a high number of dried *Entoloma* specimens, by this effort discerned nine collections of *Entoloma fulvoviolaceum*. Two of the specimens were compared with a paratype material from the Finnish type locality. Specimens from three of the Norwegian localities were sequenced and confirmed to match *Entoloma fulvoviolaceum* Noordel. & Vauras.

The size of the forest reserve is approximately 6000 hectares and was established in 2008 by the Norwegian Ministry of Environment. The spruce forest in Holmvassdalen Nature Reserve is old with a long continuity, as it has never been clearcut (Lorås and Eidissen 2012). So far 130 red-listed species of fungi are recorded in the area following the Norwegian Red List (Brandrud et al. 2010), of which 40 belong in *Entoloma*. A mix of different habitats exists in the area, among others rich fens and wooden grassland, mostly surrounded by calciphilous spruce woodlands (*Picea abies*). The localities where the finds were done share ecological features like calcareous bedrocks, humidity and vegetation. A river, Holmvassely, flows through the bottom of the valley and keeps the moisture in the air relatively constant. In addition,



Figure 1. *Entoloma fulvoviolaceum* is recognized by the brown, faintly to distinctly translucently striate and pronouncedly squamulose pileus, denser towards the darker center (JL 109-2014). Photo: J. Lorås.

calcareous water from the hillsides fertilizes the soil continuously. This process is by all accounts essential to the occurrence and distribution of most *Entoloma* species in the nature reserve (Lorås and Eidissen 2011).

#### DESCRIPTION OF THE NORWEGIAN MATERIAL

The first specimens assumed to be *E. fulvoviolaceum* were found in 2009. Both macroscopy and microscopy tallied well with the original description, except the colour of the stipe which was more blue than violaceous. Since this was the first find of the species in Norway, we contacted Jukka Vauras in order to have his opinion. He kindly sent an isoparatype and pictures, so we could make a micro-

scopical comparison with our material. This examination showed good compliance, hence, we felt comfortable that our material from Holmvassdalen really was *E. fulvoviolaceum*. In 2010 a new find was made having the same characters and accordingly it was concluded that this one also was *E. fulvoviolaceum*. Later on, the isoparatype of *E. fulvoviolaceum* received from Jukka Vauras was sequenced. The result showed a perfect match with our specimens from Holmvassdalen.

Since 2010, several other finds made us suspect we had more specimens of *E. fulvoviolaceum*. In 2014 the

ITS region of seven of these collections were sequenced by Pablo Alvarado Garcia at ALVALAB. Four of them failed in obtaining



Figure 2. *Entoloma fulvoviolaceum* with a pale brown pileus and some darker center (JL 103-2014). Photo: J. Lorås.

good sequences, whilst sequences from three collections, one from 2011 and two from 2014, were analysed by Bálint Dima who found them to match with a sequence of *E. fulvoviolaceum* from Finland deposited in BOLD database. This Finnish specimen is the isotype of *E. fulvoviolaceum* sequenced in the framework of the Finnish Barcode of Life project (B. Dima, pers. comm.). Thus our identification based on morphological characters is supported by the ITS sequence data too, and we think it is a valid conclusion that we at least have five finds of *E. fulvoviolaceum* from Holmvassdalen.

*Entoloma fulvoviolaceum* is a species in subgenus *Leptonia* and belongs to the section *Cyanulum* and stirpe *Asprellum* (Noordeloos, 2004). The stirpe is featured by brown pileus colours and blue polished stipes. Macroscopically *E. fulvoviolaceum* is recognized by the brown, faintly to distinctly translucently striate and pronouncedly squamulose pileus, denser towards the darker disc (Figs. 1 and 2). The lamellae are pale, cream-coloured, and with concolorous edge (Fig. 3).

The stipe is originally described with a “delicately violaceous” stipe, “palescent with age” (Noordeloos 2004). No developmental stages of carpophors from Holmvassdalen demonstrated violaceous colours. According to Vauras the violaceous stipe colour shown in Noordeloos (2004) is too strong (pers. comm.). This is also seen in the received pictures (Figs. 4 and 5). The stipe colour in our finds varied from dark to light blue, independent of age (Figs. 6 and 7). The pileus is originally described as “deep orange brown with darker



Figure 3. Lamellae of *Entoloma fulvoviolaceum* are pale, cream-colored, and with concolorous edge (JL 103-2014). Photo: J. Lorås.

reddish brown centre”, while our finds showed variation from reddish brown to more pure brown colours, scarcely to be perceived as orange brown.

Apart from the discrepancies in colour shades, the specimens from Holmvassdalen comply macroscopically well with the pictures of *E. fulvoviolaceum* from Finland.

Microscopically the species is recognized by lack of clamps and numerous, predominantly clavate cheilocystidia, smaller than or scarcely protruding the basidia, less than 40  $\mu\text{m}$  long. The pileipellis was originally described with brown intracellular pigment and made up of “broadly clavate to subglobose terminal elements”. This agrees well with our material, but the terminal cells were in some specimens slightly longer than the size given in the original description, see Fig. 8.

*Entoloma fulvoviolaceum* keys out close to *E. sodale* and *E. poliopus* (Noordeloos 2004). According to the key it differs from those by pileus and stipe colours. As discussed above, based on the material from Holmvassdalen, the colours can not be found valid as an unambiguous separating character. However,



Figure 4 and 5. The stipe is originally described with a “delicately violaceous” stipe, “palescent with age”. Photos showing clearly conifer needles in the habitat. Photos: J. Vauras.



better be recognized by the typical, nicely squamulose pileus, combined with a blue, polished stipe. *Entoloma poliopus* could be discerned by a different squamulose pattern, and *E. sodale* by a more distinctly translucent striate pileus. Microscopically *E. sodale* and *E. poliopus* both differ by longer and differently shaped cystidia, broadly clavate in *E. sodale* and cylindrical to clavate in *E. poliopus*. *Entoloma asprellum* in the same stirpe differs by lack of cystidia and the less and differently squamulose pileus pattern.

Originally, the spore size of *E. fulvoviolaceum* is reported as 8.5-11.0(-11.5) x 6.0-8.0 (-8.5)  $\mu\text{m}$ , with  $Q_{av} = 1.3-1.6$ . Table 1 indicates that it is a larger size variation than given, and we also found that the paratype we received from Vauras had larger spores than given in the original description. In



Figure 6. In spite of the original descriptions of *Entoloma fulvoviolaceum* saying "delicately violaceous" stipe color, our finds varied from dark to light blue (JL 109-2014). Photo: J. Lorås.

Table 1 our measurements are given and it is seen that spores reaching 12-13  $\mu\text{m}$  are not unusual. Both the size given for the typus and the paratypus are within the variation of the finds from Holmvassdalen.

#### Material studied

**UTM coordinates refers to UTM (WGS84) zone 33W**

Norway: Nordland: Grane: Holmvassdalen, det. Ø. Weholt

- a) UTM 7244846, 420877, Aug. 11, 2009, leg. M. Eidissen 7571-7573;
- b) UTM7243802, 420766, Sept. 7, 2010, leg. J. Lorås 1275-1281;
- c) UTM 7246395, 421935, 3 Sept. 2011, leg. J. Lorås JL178-2011;
- d) UTM 7246494, 421771, Sept. 7, 2014, leg. J. Lorås and S. E. Eidissen JL103-2014
- e) UTM 7246485, 421736, Sept. 7, 2014, leg.



Figure 7. This specimen of *Entoloma fulvoviolaceum* has a light blue stipe, rather different from a violaceous color (JL 103-2014). Photo: J. Lorås.

J. Lorås and S. E. Eidissen JL109-2014

#### DISTRIBUTION AND ECOLOGY

Coll. a) Found in rich calcareous meadow of low-herbs, among others with *Parnassia palustris*

Coll. b) Found in a calcareous mixed forest, dominated by spruce

Coll. c) Found in a meadow of tall-herbs, dominated by *Aconitum lycoctonum ssp. septentrionale*

Coll. d) Found in an old spruce forest on bare soil in a humid area

Coll. e) Found in moss in a meadow of low-herbs, surrounded by old calcareous spruce forest

Although calcareous influence is mentioned for only three of the finds, we can be sure that the soil also is calcareous for the two others since belts of limestone are cutting through the whole nature reserve. The old spruce forest stands and the rich meadows in the area are typical habitats for the *Entoloma* species found in the area. These vegetation types also provide conditions for a number of other very rare species, among them *Entoloma holmvassdalenense* and *E. sublaevisporum* (Weholt et al. 2014), and *E. gomerense* (Lorås et al. 2014).

The type locality of *E. fulvoviolaceum* is in a southern region of Finland and consequently the localities in Holmvassdalen are the northernmost. The habitat in Finland is described briefly as “in mixed deciduous forest on calcareous soil” (Noordeloos 2004:1083). It is also said to grow in groups (Noordeloos 2012).

However, two photos show clearly conifer

needles in the habitat (Fig. 4 and 5), while the text exclusively mentions mixed deciduous forest. (Noordeloos 2004:1328). Conifers therefore very probably have been present very close to the fungi. In Holmvassdalen Nature Reserve conifers are present at all five sites, which clearly shows that *E. fulvoviolaceum* also occurs in spruce forest. In fact, our finds indicate that this is the normal preference in Holmvassdalen. Normally the number of specimens for each find is one, sometimes two, which diverges from previous indications.

Common for all finds, including the Finnish one, is the presence of calcareous soils. *Entoloma fulvoviolaceum* seems therefore to be a species requiring lime. The species grows in meadows of both low-herbs and tall-herbs, often with a field layer of moss that retains moisture. When moss is lacking, it seems to be able to live on bare, moist soil.

The finds of *Entoloma fulvoviolaceum* in Holmvassdalen are concentrated to the northern and lowest part of the valley.

Overall, our knowledge of the variability and distribution pattern is rather incomplete of *E. fulvoviolaceum*. This applies both to colour variations of cap and stipe as to the habitats of the species. The old spruce forest

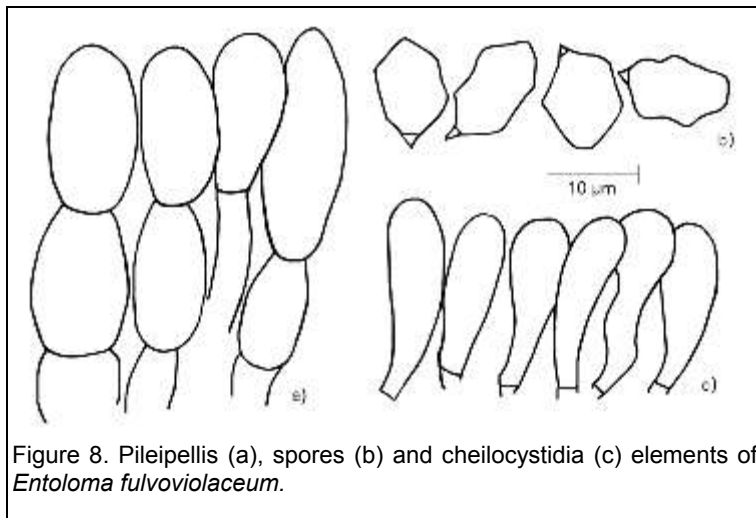


Figure 8. Pileipellis (a), spores (b) and cheilocystidia (c) elements of *Entoloma fulvoviolaceum*.

Table 1. Spore measurements of *E. fulvoviolaceum* from Holmvassdalen. 10-15 spores are measured for each collection. Letters a-e designate the different collections as specified in Materials studied below.

Isoparatypus, JV 20117 Finland, 22.08.2007	9.1-13 x 7.0-8,1 $\mu$ , Qav = 1.4
a) 7571-7573	9.2-13.0 x 8.0 -8.2 $\mu$ , Qav = 1.35
b) 1275-1281	9.8-12.2 x 7.2-8.3 $\mu$ , Qav = 1.3
c) JL178-2011 (sequenced material)	10.0-13.2 (-15) x 7.2-9,4(-10.1) $\mu$ , Qav = 1.5
d) JL103-2014 (sequenced material)	10.0-13.2 (-14) x 7.0-8.0 $\mu$ , Qav = 1.6
e) JL109-2014 (sequenced material)	9.2-10.5(-12) x 7.0-8.2 $\mu$ , Qav = 1.4

constitutes the very foundation of this species' distribution in the area.

#### ACKNOWLEDGMENTS

We would like to thank Balint Dima, Hungary for the kind help in interpretation of the sequences of *E. fulvoviolaceum* and to Pablo Alvarado Garcia at the ALVALAB, Spain for the sequence work. And also thanks to Jukka Vauras for sending us an isoparatypus of *Entoloma fulvoviolacum* and for allowing us to use some of his pictures.

#### REFERENCES

- Brandrud TE, Bendiksen E, Hofton TH, Høiland K, Jordal JB, 2010. Sopp. Fungi, in: Kålås JA, Viken Å, Henriksen S, Skjelseth S (Eds.), The 2010 Norwegian red list for species. Artsdatabanken, The Norwegian biodiversity information centre, Trondheim, pp. 87-123.
- Lorås J, Eidissen SE, 2011. Rødlistede beitemarksopp i kalkgranskog - arter, økologi og habitatpåvirkning i Holmvassdalen naturreservat. *Agarica* 31: 45-56.
- Lorås J, Eidissen, SE, 2012. Holmvassdalen naturreservat – botanisk mangfold og kontinuitet i granskog. *Blyttia* 70: 73-88.
- Lorås J, Weholt Ø, Eidissen SE, 2014. *Entoloma gomerense* Wölfel & Noordel. – a new species to Northern Europe. *Agarica* 35: 19-24.
- Noordeloos ME, 2004. *Entoloma* s. l. Fungi Europaei 5A. Candusso, Alessio.
- Noordeloos ME, 2012. *Entoloma* (Fr.) P. Kumm., in: Knudsen H, Vesterholt J (Eds.). *Funga Nordica*. Nordsvamp, Copenhagen, pp. 517-576.
- Weholt Ø, Lorås J, Eidissen SE, 2014. One new and one rare species of *Entoloma* from the Norwegian nature reserve Holmvassdalen. *Österreichische Zeitschrift für Pilzkunde* 23: 55-60.